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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003901612 for a patent by HEAD ELECTRICAL INTERNATIONAL PTY LTD as filed on 04 April 2003.

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Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant(s):

HEAD ELECTRICAL INTERNATIONAL PTY LTD

A.C.N. 093 143 027

Invention Title:

AN ELECTRICAL CONNECTION DEVICE

The invention is described in the following statement:

AN ELECTRICAL CONNECTION DEVICE

Field of the Invention

The present invention broadly relates to an electrical connection device for a machine cable. Throughout this specification the term "machine cable" is used for any machine, reeling or trailing cable. The term "connector" is used for any plug, lug, electrical adaptor, coupler or receptacle.

Background of the Invention

Machine cables are typically used to provide an electrical connection for mobile electrical machines. For example, in the mining or petroleum industry often large electrical machinery is used and each machine cable may have to provide power in the order of a few hundred kilowatts. Typically such power is delivered with a voltage of one or more kilovolts. The cables usually comprise a plurality of cores and are connected using connectors including sockets and pins.

In an explosive environment, for example, particular precaution must be taken and a flame path may be required between the two connectors to reduce likelihood of explosions. The flame path typically is formed between a plug and a receptacle by positioning a cylindrical surface that surrounds contacts and/or electrical leads of the plug inside a respective cylindrical surface of the receptacle. The mechanical tolerance between the cylindrical surfaces is fine (typically 0.1mm). As a consequence of the fine mechanical tolerance, canting or seizing may occur which makes it difficult to engage or disengage plug and receptacle.

It is known in the art to have a pawl and slot

arrangement on a side of the plug and the receptacle which can be used to drive the plug and the receptacle together to engage pins and sockets and the surfaces that form the flame path.

Summary of the Invention

The present invention provides an electrical connection device for a machine cable, the device comprising:

a first connector having a first contact,

a second connector having a second contact, the first contact and the second contact being moveable between a disengaged condition where the first contact and the second contact are remote from each other and an engaged condition where the contacts are in electrical contact and the device further comprising and

a driving means arranged to drive the first and the second connector relative to each other whereby the first contact and the second contact move between the disengaged and the engaged position,

wherein the driving means is arranged to impart a driving force that is distributed around the first and/or the second connector.

In the prior art the pawl and slot arrangement applies driving force at one particular location only. Consequently, wedging or canting between the connectors may occur and often large forces are required to connect the connectors. In practice, these large forces may even bent one of the connectors. In the present invention, however, the drive force is distributed around the first and/or the second connector and the likelihood of wedging, canting or seizing between the first and the second

connector therefore is reduced.

The present invention also provides an electrical connector for a machine cable, the connector having a first contact and a drive part arranged for engagement with another drive part of another connector that has a second contact, the drive part being arranged to engage with the other drive part to impart a driving force that is distributed around the connector and directed so that the connectors can be driven relative to each other whereby the first contact and the second contact move between a disengaged condition in which the first and the second contact are remote from each other and an engaged condition in which the contacts are in electrical contact.

Preferred Features of the Invention

The first contact preferably is a pin and the second contact preferably is a socket. Alternatively, the first contact may be a socket and the second contact may be a pin. The pin may also be one of a plurality of pins and the socket may be one of a plurality of sockets.

The drive means preferably has a first drive part and a second drive part. The first drive part and the second drive part preferably are arranged so that the driving force is distributed substantially equally around the first and/or the second connector. In this case the first drive part may comprise an element that at least in part surrounds the first connector. The element preferably surrounds the first connector entirely and is arranged to impart a driving force that is substantially equal around the first connector. Alternatively, the first drive part may be arranged to impart the drive force at discrete positions that at least in part surround the first

connector.

The first drive part and the second drive part preferably are arranged so that the first and the connectors can be driven relative to each other along a substantially liner path.

The first drive part may be a threaded drive and the second drive part may a threaded portion.

The threaded portion preferably forms a part of the exterior surface of the second connector. The threaded portion most preferably comprises a helical groove that is positioned so that an imaginary axis about which the helical groove is oriented is substantially parallel to the movement of the first contact and the second contact relative to each other.

The threaded drive preferably comprises a geared arrangement. The geared arrangement preferably comprises a toothed shaft and a toothed wheel. The toothed wheel preferably is ring-like and has a toothed inner peripheral surface and a toothed outer peripheral surface. The geared arrangement preferably is arranged so that the toothed shaft engages with the outer peripheral toothed surface of the ring-like toothed wheel. The inner peripheral toothed surface of the ring-like toothed wheel most preferably is arranged to engage with the helical groove. The toothed shaft preferably is rotatable but captured in position relative to the first connector. The geared arrangement preferably is arranged so that a rotational motion of the toothed shaft is translated by the toothed wheel into a translational relative movement of the connectors.

One of the first and the second connectors may have a elongate groove on its outer peripheral surface that is oriented along the imaginary axis. In this case the other connector may have a projection that is arranged to slide

in the elongate groove. The elongate groove and the projection preferably are arranged so that, in use, a rotation of the first connector relative to the second connector is avoided.

Brief Description of the Drawings

Figure 1 shows a schematic representation (in part in cross-section) of a connector according to a preferred embodiment of the invention,

Figure 2 shows a schematic cross-sectional representation of a connector according to another preferred embodiment of the invention and

Figure 3 shows (a), (b) side views of toothed wheels, (c) a cross-sectional representation of a toothed shaft and (d) a side view of the toothed shaft according to embodiments of the invention.

Detailed Description of Preferred Embodiments of the Invention

Referring to Figures 1 to 3, an electrical connection device according to a preferred embodiment of the invention is now described. In this embodiment, the electrical connection device comprises connector 10 and connector 50. Connector 10 is a plug and connector 50 is a receptical arranged to receive the plug 10.

The plug 10 comprises a body 11 that is of substantially cylindrical shape and an outer shell 12 composed of metallic and/or insulating material(s). The connector 10 has an end-face 13 that has three apertures (only two are shown in Figure 1) that are defined by nuts such as nuts 14 and 16. From each aperture an insulating sleeve 18 projects inwardly. The pin 20 is connected to a part 22 which is connected to an individual core 24 of a

multi-core machine cable 26. A further core 28 of the multi-core machine cable is also shown (not connected).

The outer shell comprises a helical groove 34. Figures 1 to 3 also show a ring-like toothed wheel 36 and a toothed shaft 38. The inner toothed surface 40 is engaged (meshed) with the helical groove 34 and the outer toothed surface 42 is engaged (meshed) with the toothed shaft 38.

Figure 2 shows a receptacle 50 comprising an outer shell 51. The outer shell locates the toothed shaft 38 and the toothed wheel 36 so that the toothed wheel is rotatable about an imaginary longitudinal central axis of the receptacle 50 and the toothed shaft 38 is rotatable about a direction perpendicular to that. The receptacle 50 also comprises sockets 52 arranged for engagement with pins such as pin 20 shown in Figure 1. Pairs of the sockets 52 are electrically connected and held in position by insulating body 53. The insulating body 53 also comprises earth connections 54.

When the plug 10 is engaged with receptacle 50, a flame path is defined by surface 55 (see Figure 2) and surface 56 (see Figure 1). Surface 55 and surface 56 are shaped so that the mechanical tolerance between the surfaces of the engaged plug 10 and receptacle 50 is of the order of 0.1mm.

Figure 3 (b) shows the toothed wheel 36 in greater detail. Figure 3 (a) a toothed wheel 60 according to a variation of this embodiment. In this case the toothed wheel comprises an inner toothed portion for engagement with helical groove 34 and the outer periphery has a number of recesses for reception of a lever (not shown). The lever may be used to turn the toothed wheel 60. In this case, no toothed shaft such as toothed shaft 38 is

required.

The tooth wheel 36 and the toothed shaft 38 form a worm-drive and a rotational motion of the toothed shaft 38 is translated into a rotational motion of the toothed wheel 36. The rotational motion of the toothed wheel 36 is translated into a linear movement of the receptacle 50 relative to the plug 10 whereby pins such as pin 20 and sockets 52 as well as surfaces 55 and 56 move between a disengaged and an engaged condition.

In this embodiment the plug 10 also has a longitudinal groove (not shown) that extends on the outer shell 12 in a direction parallel to the imaginary axis about which the helical groove 34 is wound. The receptacle 50 has a respective projection (not shown) that is arranged to slide within the groove. The groove and the projection therefore avoid a rotation of the plug 10 relative to the receptacle 50.

Although the invention has been described with reference to particular examples, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms. For example, the device may comprise a plug and a receptacle and a plurality of substantially equally spaced apart drive arrangements may surround the plug or the receptacle. In this case the drive arrangements may be arranged to impart driving forces at spaced apart positions. Also, the ring-like toothed wheel may have a toothed portion on one of its side surfaces arranged for engagement with a toothed shaft such as shaft 38. Further, it will be understood that the device is not limited to one connector being a plug and the other connector being a receptacle. For example, both connectors may be suitable plugs or one of them may be a lug.

The Claims defining the Invention are as follows:

1. An electrical connection device for a machine cable, the device comprising:

a first connector having a first contact,

a second connector having a second contact, the first contact and the second contact being moveable between a disengaged condition where the first contact and the second contact are remote from each other and an engaged condition where the contacts are in electrical contact and the device further comprising and

a driving means arranged to drive the first and the second connector relative to each other whereby the first contact and the second contact move between the disengaged and the engaged position,

wherein the driving means is arranged to impart a driving force that is distributed around the first and/or the second connector.

2. The electrical connection device as claimed in claim 1 wherein the first contact is a pin and the second contact is a socket.

3. The electrical connection device as claimed in claim 1 wherein the first contact is a socket and the second contact is a pin.

4. The electrical connection device as claimed in any one of claims 1 to 3 wherein the drive means has a first drive part and a second drive part.

5. The electrical connection device as claimed in claim 4 wherein the first drive part and the second drive part

are arranged so that the driving force is distributed substantially equally around the first and/or the second connector.

5. The electrical connection device as claimed in claim 4 wherein the first drive part comprises an element that at least in part surrounds the first connector.

6. The electrical connection device as claimed in claim 5 wherein the element surrounds the first connector entirely and is arranged to impart a driving force that is substantially equal around the first connector.

7. The electrical connection device as claimed in claim 3 or 4 wherein the first drive part is arranged to impart the drive force at discrete positions that at least in part surround the first connector.

8. The electrical connection device as claimed in any one of claims 3 to 7 wherein the first drive part and the second drive part are arranged so that the connectors can be driven relative to each other along a substantially liner path.

9. The electrical connection device as claimed in any one of claims 4 to 8 wherein the first drive part is a threaded drive and the second drive part is a threaded portion.

10. The electrical connection device as claimed in claim 9 wherein the threaded portion forms a part of the exterior surface of the second connector.

11. The electrical connection device as claimed in claim 10 wherein the threaded portion comprises a helical groove that surrounds the second connector and is positioned so that an imaginary axis about which the helical groove is wound is substantially parallel to the movement of the first contact and the second contact relative to each other.

12. The electrical connection device as claimed in any one of claims 9 to 11 wherein the threaded drive comprises a geared arrangement.

13. The electrical connection device as claimed in claim 12 wherein the geared arrangement comprises a toothed shaft and a toothed wheel.

14. The electrical connection device as claimed in claim 13 wherein the toothed wheel is ring-like and has a toothed inner peripheral surface and a toothed outer peripheral surface.

15. The electrical connection device as claimed in claim 14 wherein the geared arrangement is arranged so that the toothed shaft engages with the outer peripheral toothed surface of the ring-like toothed wheel.

16. The electrical connection device as claimed in claim 14 or 15 wherein the inner peripheral toothed surface of the ring-like toothed wheel is arranged to engage with the helical groove.

17. The electrical connection device as claimed in any one of claims 13 to 16 wherein the toothed shaft is rotatable but captured in position relative to the first connector.

18. The electrical connection device as claimed in any one of claims 13 to 17 wherein the geared arrangement is arranged so that a rotational motion of the toothed shaft is translated by the toothed wheel into a translational relative movement of the connectors.

19. The electrical connection device as claimed in claim 11 or any one of claims 12 to 18 when dependent on claim 11 wherein one of the first and the second connectors has a elongate groove on its outer peripheral surface and oriented along the imaginary axis and the other connector has a projection that is arranged to slide in the elongate groove.

20. The electrical connection device as claimed in claim 19 wherein the elongate groove and the projection are arranged so that, in use, a rotation of the first connector relative to the second connector is avoided.

21. An electrical connector for a machine cable, the connector having a first contact and a drive part arranged for engagement with another drive part of another connector that has a second contact, the drive part being arranged to engage with the other drive part to impart a driving force that is distributed around the connector and directed so that the connectors can be driven relative to each other whereby the first contact and the second contact move between a disengaged condition in which the

first and the second contact are remote from each other and an engaged condition in which the contacts are in electrical contact.

DATED this 4rd day of APRIL 2003

HEAD ELECTRICAL INTERNATIONAL PTY LTD

By their Patent Attorneys

GRIFFITH HACK

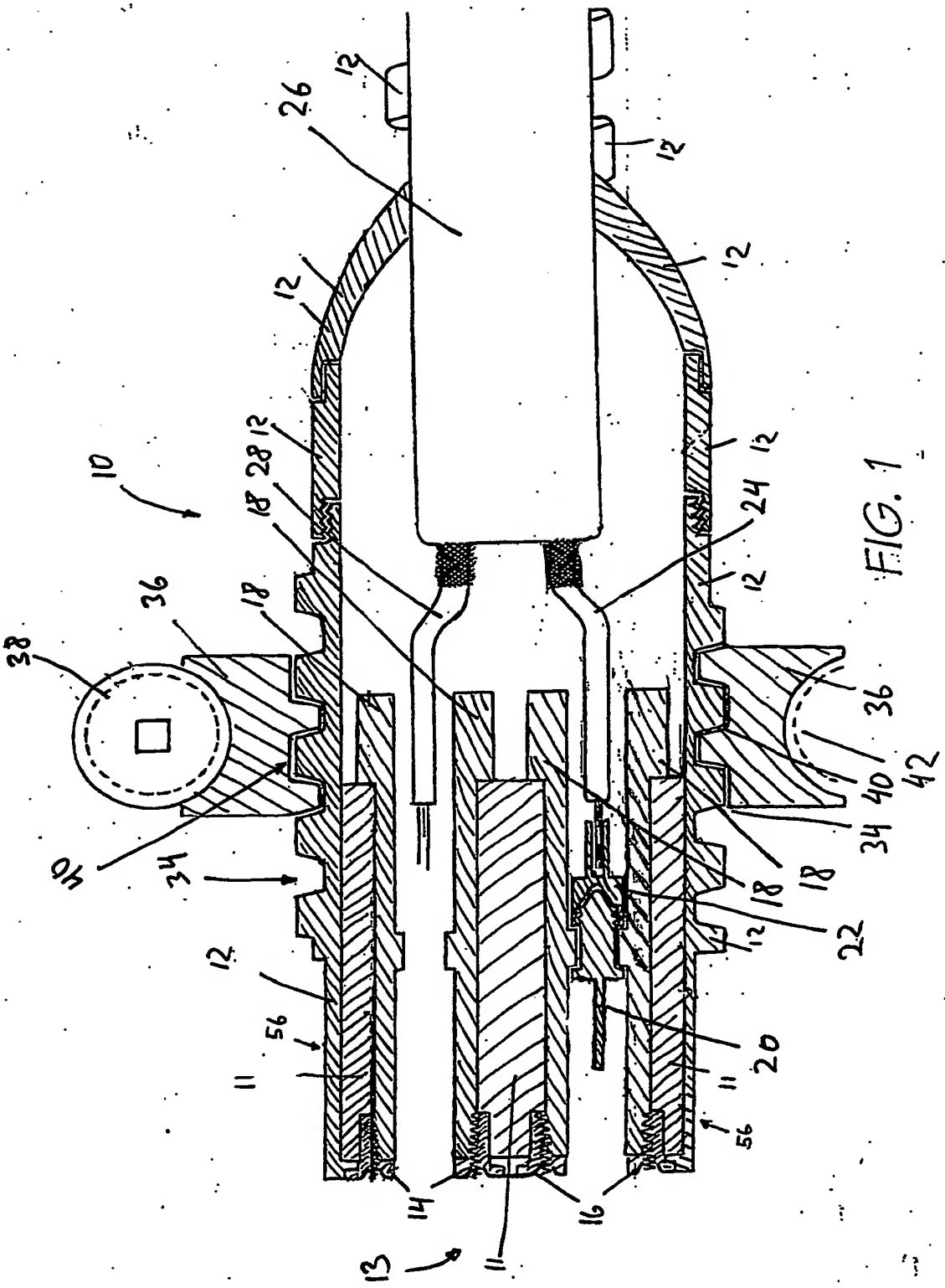

FIG. 1

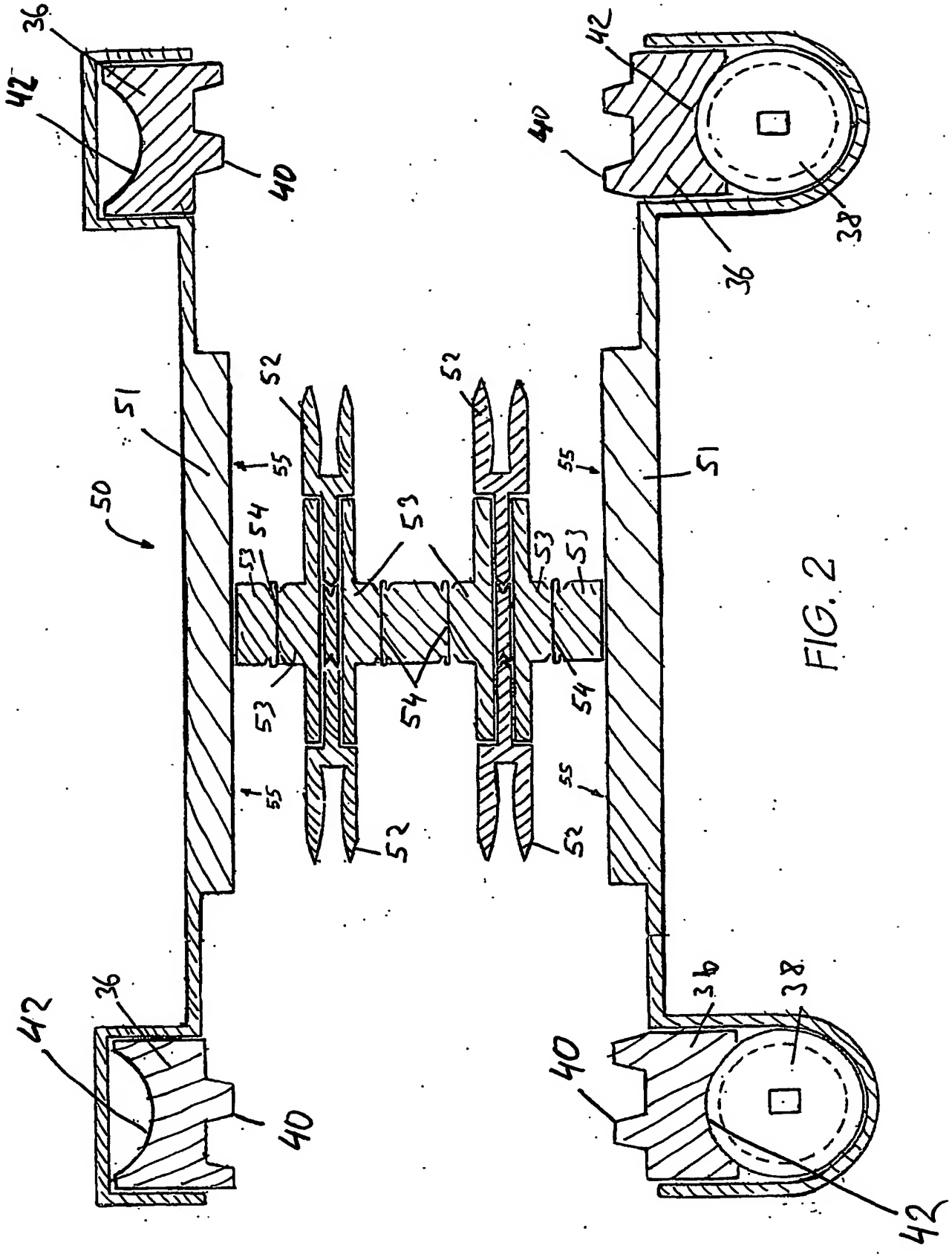

FIG. 2

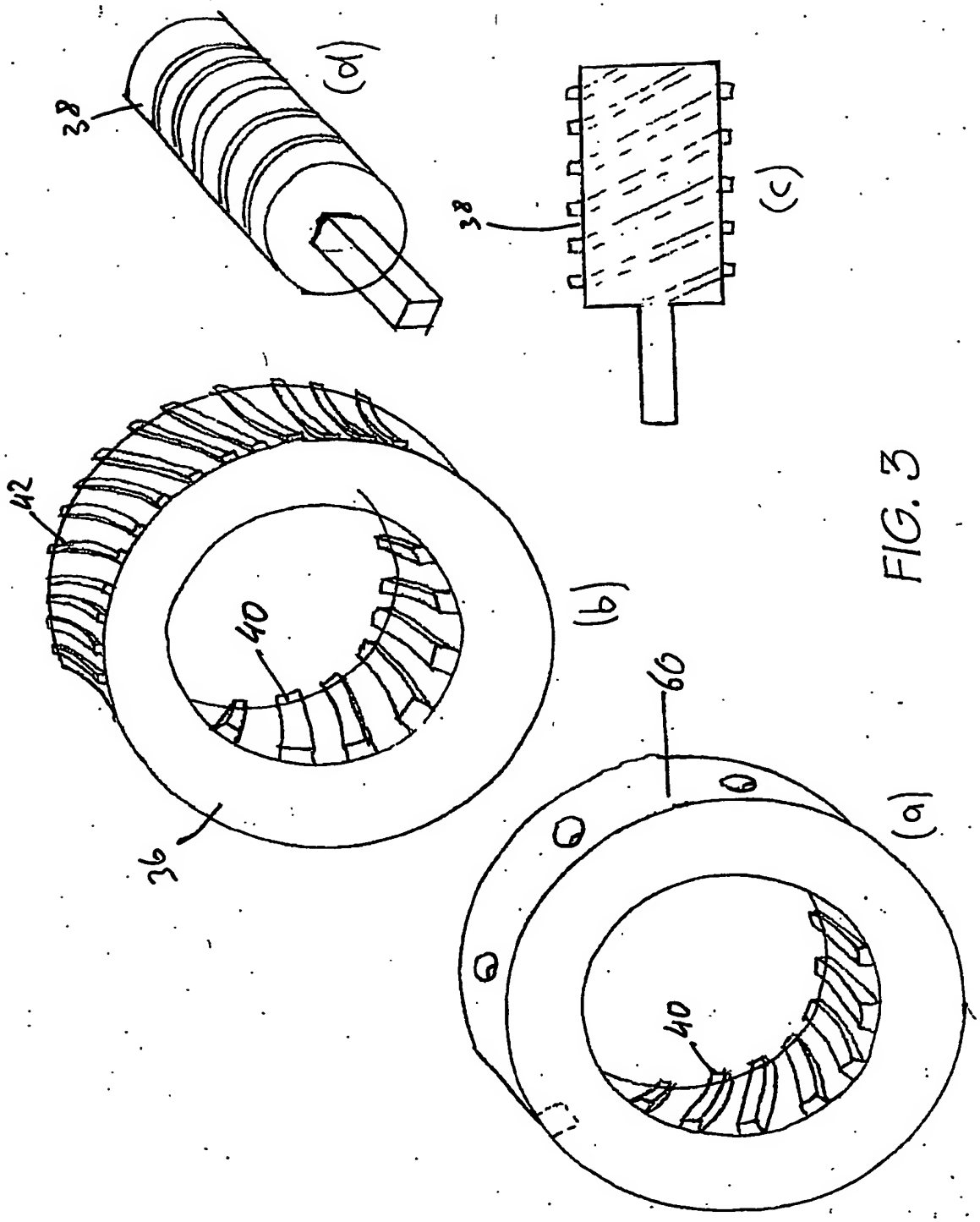

FIG. 3